CLAIMS

1. A carrier for supporting a microelectronic substrate relative to a planarizing medium during planarization of the microelectronic substrate, the carrier comprising:

a support member; and

a flexible, compressible membrane adjacent to the support member, the membrane having a first portion with a first thickness and a second portion with a second thickness greater than the first thickness, the first portion of the membrane being aligned with a first part of the microelectronic substrate when the membrane engages the microelectronic substrate, the second portion of the membrane being aligned with a second part of the microelectronic substrate when the membrane engages the microelectronic substrate.

2. The carrier of claim 1, further comprising a retainer coupled to the membrane and positioned at least partially between the membrane and the support member to at least restrict motion of the membrane relative to the support member.

3. The carrier of claim 1 wherein the membrane and at least a portion of the support member define an at least approximately gas tight volume and the membrane is inflatable from a collapsed position to an inflated position with at least part of the membrane spaced apart from the support member when the membrane is in the inflated position.

4. The carrier of claim 1 wherein the membrane has a first surface facing a generally flat surface of the support member and a second surface facing opposite the first surface toward the microelectronic substrate when the membrane engages the microelectronic substrate, the first surface being generally in direct contact with the flat surface of the support member.

5. The carrier of claim 1 wherein the membrane has a generally circular planform shape and the first and second portions of the membrane are annular with the first portion disposed radially inwardly from the second portion.

6. The carrier of claim 5 wherein the first and second portions of the membrane are concentric.

7. The carrier of claim 1 wherein the membrane has a generally circular planform shape and the first and second portions are annular with the second portion disposed radially inwardly from the first portion.

8. The carrier of claim 1 wherein the membrane includes a membrane material and the membrane is formed by injecting the membrane material into a mold.

9. The carrier of claim 1 wherein the membrane includes at least one of neoprene and silicone.

10. The carrier of claim 1 wherein the first thickness of the membrane is approximately 0.030 inches.

11. The carrier of claim 1 wherein a ratio of the second thickness of the membrane to the first thickness of the membrane is less than approximately two.

12. The carrier of claim 1 wherein the first and second portions are adjacent to each other.

13. The apparatus of claim 1 wherein the first and second portions of the membrane are radially disposed relative to each other and an intermediate

thickness of the membrane varies in a generally continuous manner between the first thickness and the second thickness.

14. A carrier for supporting a microelectronic substrate relative to a planarizing medium during planarization of the microelectronic substrate, the carrier comprising:

a support member;

a flexible, compressible membrane having a first portion with a first thickness and a second portion with a second thickness greater than the first thickness, the first portion being aligned with a first part of the microelectronic substrate when the membrane engages the microelectronic substrate, the second portion being aligned with a second part of the microelectronic substrate when the membrane engages the microelectronic substrate; and

a retainer engaged with the support member and the membrane to at least restrict motion of the membrane relative to the support member.

15. The carrier of claim 14 wherein the support member and the membrane each have a generally circular planform shape.

16. The carrier of claim 14 wherein the retainer has a generally circular planform shape.

17. The carrier of claim 14 wherein the membrane has a generally circular planform shape and the first and second portions are annular with the first portion disposed radially inwardly from the second portion.

18. The carrier of claim 14 wherein the membrane has a generally circular planform shape and the first and second portions are annular with the second portion disposed radially inwardly from the first portion.

19. The carrier of claim 14 wherein the retainer includes a support plate and a retainer ring releasably coupled to the support plate with threaded screws, further wherein at least a portion of the membrane is clamped between the support plate and the retainer ring.

20. The carrier of claim 14 wherein retainer forms an at least partially gas tight seal with the membrane and the membrane is inflatable from a collapsed position to an inflated position with at least part of the membrane being spaced apart from the retainer when the membrane is in the inflated position.

21. The carrier of claim 14 wherein the membrane has a first surface facing a generally flat surface of the retainer and a second surface facing opposite the first surface toward the microelectronic substrate when the membrane engages the microelectronic substrate, the first surface being generally in direct contact with the flat surface of the retainer.

22. The carrier of claim 14 wherein the membrane includes at least one of neoprene and silicone.

23. The carrier of claim 14 wherein the membrane is a first membrane with a ratio of the first thickness to the second thickness having a first value, further comprising a second membrane configured to be engaged with the retainer in place of the first membrane, the second membrane having a first portion with a first thickness and a second portion with a second thickness different than the first thickness, a ratio of the first thickness of the second membrane to the second thickness of the second membrane having a second value different than the first value.

24. The carrier of claim 14 wherein the first and second portions of the membrane are radially disposed relative to each other and an intermediate

thickness of the membrane varies in a generally continuous manner between the first thickness and the second thickness.

25. An apparatus for planarizing a microelectronic substrate, comprising:

a planarizing medium support;

a planarizing medium supported by the planarizing medium support;

a substrate carrier positioned proximate to the planarizing medium, the substrate carrier including a flexible, compressible membrane having a first portion with a first thickness and a second portion with a second thickness different than the first thickness, the first portion being aligned with a first part of the microelectronic substrate when the membrane engages the microelectronic substrate, the second portion being aligned with a second part of the microelectronic substrate when the membrane engages the microelectronic substrate.

26. The apparatus of claim 25 wherein the planarizing medium includes a polishing pad having a generally circular planform shape and the planarizing medium has a corresponding circular planform shape.

27. The apparatus of claim 25 wherein the planarizing medium includes an elongated polishing pad at least partially wound on a supply roller and extending from the supply roller across the planarizing medium support to a take-up roller.

28. The apparatus of claim 25, further comprising an actuator coupled to the substrate carrier to bias the substrate carrier toward the planarizing medium.

29. The apparatus of claim 25, further comprising an actuator coupled to the substrate carrier to move the substrate carrier relative to the planarizing medium in a plane generally parallel to a plane of the planarizing medium.

30. The apparatus of claim 25 wherein the substrate carrier includes a support member and a retainer engaged with the support member, the retainer being coupled to the membrane to at least restrict motion of the membrane relative to the support member.

31. The apparatus of claim 25 wherein the membrane and a portion of the substrate carrier define an at least approximately gas tight volume with the membrane being inflatable from a first position to a second position, at least part of the membrane being spaced apart from the portion of the substrate carrier when the membrane is in the second position.

32. The apparatus of claim 25 wherein the membrane has a first surface facing a generally flat surface of the substrate carrier and a second surface facing opposite the first surface toward the microelectronic substrate when the membrane engages the microelectronic substrate, the first surface being generally in direct contact with the flat surface of the substrate carrier.

33. The apparatus of claim 25 wherein the membrane has a generally circular planform shape and the first and second portions are annular with the first portion disposed radially inwardly from the second portion.

34. The apparatus of claim 25 wherein the membrane has a generally circular planform shape and the first and second portions are annular with the second portion disposed radially inwardly from the first portion.

35. The apparatus of claim 25 wherein the first and second portions of the membrane are radially disposed relative to each other and as intermediate thickness of the membrane varies in a generally continuous manner between the first thickness and the second thickness.

36. The apparatus of claim 25 wherein the substrate carrier is a first substrate carrier and the membrane is a first membrane with a ratio of the first thickness to the second thickness having a first value, further comprising a second substrate carrier with a second membrane having a first portion with a first thickness and a second portion with a second thickness different than the first thickness, a ratio of the first thickness of the second membrane to the second thickness of the second membrane having a second value different than the first value.

37. A method for planarizing a microelectronic substrate, comprising:

biasing the microelectronic substrate against a planarizing medium with a flexible membrane to exert a first force on a first part of the microelectronic substrate and exert a second force greater than the first force on a second part of the microelectronic substrate; and

moving at least one of the microelectronic substrate and the planarizing medium relative to the other to remove material from the microelectronic substrate.

38. The method of claim 37, further comprising:

engaging the first part of the microelectronic substrate with a first portion of the flexible membrane having a first thickness;

engaging the second part of the microelectronic substrate with a second portion of the flexible membrane having a second thickness greater than the first thickness.

39. The method of claim 38 wherein engaging a first part of the microelectronic substrate includes engaging a first annular part of the microelectronic substrate and engaging the second part of the microelectronic substrate includes engaging a second annular part of the microelectronic substrate disposed radially inwardly from the first annular part of the microelectronic substrate.

40. The method of claim 39 wherein engaging a first part of the microelectronic substrate includes engaging a first annular part of the microelectronic substrate and engaging the second part of the microelectronic substrate includes engaging a second annular part of the microelectronic substrate disposed radially outwardly from the first annular part of the microelectronic substrate.

41. The method of claim 37 wherein biasing the microelectronic substrate against the planarizing medium includes inflating the membrane.

42. The method of claim 37 wherein the membrane has a first surface facing toward the microelectronic substrate and a second surface facing generally opposite the first surface, further wherein biasing the microelectronic substrate against the planarizing medium includes biasing a generally flat support member against the second surface of the membrane.

43. The method of claim 37 wherein biasing the microelectronic substrate against a planarizing medium includes biasing the microelectronic substrate against a first portion of a polishing pad, further wherein moving the at least one of the microelectronic substrate and the planarizing medium includes advancing the polishing pad from a supply roller to a take-up roller to engage a second portion of the polishing pad with the first and second parts of the microelectronic substrate

44. The method of claim 37, further comprising forming the membrane by disposing a membrane material in a mold.

45. The method of claim 37, further comprising forming the membrane by providing a first ply of a membrane material at the first and second portions of the membrane and attaching a second ply of the membrane material to the first ply at the second portion of the membrane.

46. The method of claim 37 wherein moving at least one of the microelectronic substrate and the planarizing medium relative to the other includes moving the first part of the microelectronic substrate and the planarizing medium at a first linear velocity relative to each other and moving the second part of the microelectronic substrate and the planarizing medium at a second linear velocity relative to each other, further wherein removing material from the microelectronic substrate includes removing material from the first part of the microelectronic substrate at a first rate and removing material from the second part of the microelectronic substrate at a second rate approximately the same as the first rate.

47. The method of claim 37 wherein the membrane is the first of a first and second membrane, each membrane having a first portion with a first thickness and a second portion with a second thickness, a ratio of the first thickness to the second thickness of the first membrane having a first value, a ratio of the first thickness to the second thickness of the second membrane having a second value different than the first value, further comprising selecting the first membrane from the first and second membranes.

48. A method for planarizing a microelectronic substrate, comprising:

biasing a first annular part of the microelectronic substrate against a planarizing medium with a first force by engaging the first annular part with a first portion of a flexible membrane having a first thickness;

biasing a second annular part of the microelectronic substrate against the planarizing medium with a second force greater than the first force by engaging the second annular part with a second portion of the flexible membrane having a second thickness greater than the first thickness; and

moving at least one of the microelectronic substrate and the planarizing medium relative to the other to remove material from the microelectronic substrate.

49. The method of claim 48 wherein biasing the microelectronic substrate against the planarizing medium includes inflating the membrane.

50. The method of claim 48 wherein the membrane has a first surface facing toward the microelectronic substrate and a second surface facing generally opposite the first surface, further wherein biasing the microelectronic substrate against the planarizing medium includes biasing a generally flat support member against the second surface of the membrane.

51. The method of claim 48 wherein biasing the microelectronic substrate against a planarizing medium includes biasing the microelectronic substrate against a first portion of a polishing pad, further wherein moving the at least one of the microelectronic substrate and the planarizing medium includes advancing the polishing pad from a supply roller to a take-up roller to engage a second portion of the polishing pad with the first and second parts of the microelectronic substrate

52. The method of claim 48 wherein moving at least one of the microelectronic substrate and the planarizing medium relative to the other includes moving the first part of the microelectronic substrate and the planarizing medium at a first linear velocity relative to each other and moving the second part of the microelectronic substrate and the planarizing medium at a second linear velocity relative to each other, further wherein removing material from the microelectronic substrate includes removing material from the first part of the microelectronic substrate at a first rate and removing material from the second part of the microelectronic substrate at a second rate approximately the same as the first rate.

53. The method of claim 48 wherein the membrane is the first of a first and second membrane, each membrane having a first portion with a first thickness and a second portion with a second thickness, a ratio of the first thickness to the second thickness of the first membrane having a first value, a ratio of the first

thickness to the second thickness of the second membrane having a second value different than the first value, further comprising selecting the first membrane from the first and second membranes.

54. A method for removing material from a microelectronic substrate, comprising:

engaging the microelectronic substrate with a planarizing medium;

moving at least one of a first part of the microelectronic substrate and the planarizing medium relative to the other at a first rate;

moving at least one of a second part of the microelectronic substrate and the planarizing medium relative to the other at a second rate less than the first rate;

removing material from the first and second parts of the microelectronic substrate at approximately equal rates by biasing the first part of the microelectronic substrate against the planarizing medium with a first membrane portion having a first thickness and biasing the second part of the microelectronic substrate against the planarizing medium with a second membrane portion having a second thickness greater than the first thickness.

55. The method of claim 54 wherein engaging the microelectronic substrate with the planarizing medium includes engaging the microelectronic substrate with a polishing pad.

56. The method of claim 54 wherein moving at least one of the first part of the microelectronic substrate and the planarizing medium includes moving at least one of a first annular part of the microelectronic substrate and the planarizing medium, further wherein moving at least one of the second part of the microelectronic substrate and the planarizing medium includes moving at least one of the planarizing medium and a second annular part of the microelectronic substrate positioned radially inwardly from the first annular part of the microelectronic substrate.

57. The method of claim 54 wherein biasing the microelectronic substrate against the planarizing medium includes inflating the membrane.

58. The method of claim 54 wherein the membrane has a first surface facing toward the microelectronic substrate and a second surface facing generally opposite the first surface, further wherein biasing the microelectronic substrate against the planarizing medium includes biasing a generally flat support member against the second surface of the membrane.

59. The method of claim 54 wherein biasing the microelectronic substrate against a planarizing medium includes biasing the microelectronic substrate against a first portion of a polishing pad, further wherein moving the at least one of the microelectronic substrate and the planarizing medium includes advancing the polishing pad from a supply roller to a take-up roller to engage a second portion of the polishing pad with the first and second parts of the microelectronic substrate.